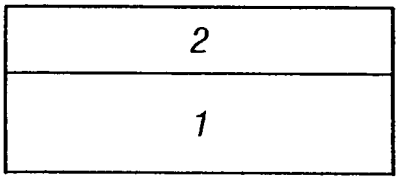

FIG. 1a

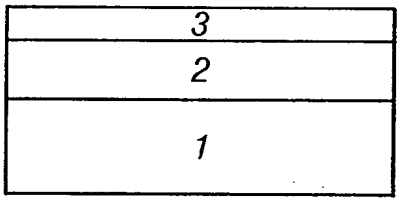

FIG. 1b

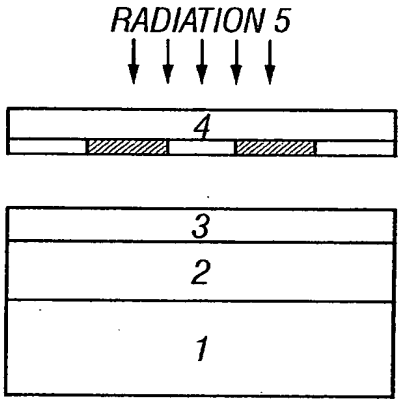

FIG. 1c

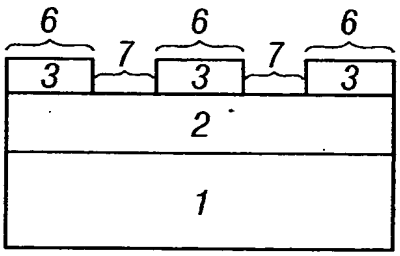

FIG. 1d

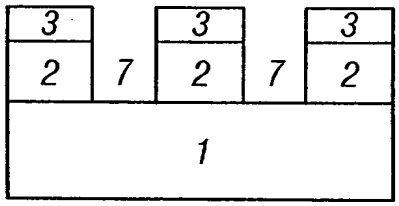

FIG. 1e

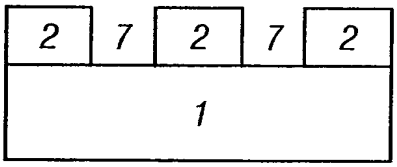

FIG. 1f

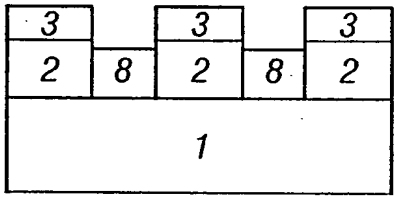

FIG. 1g

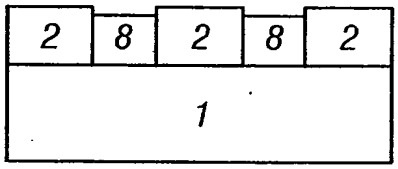

FIG. 1h

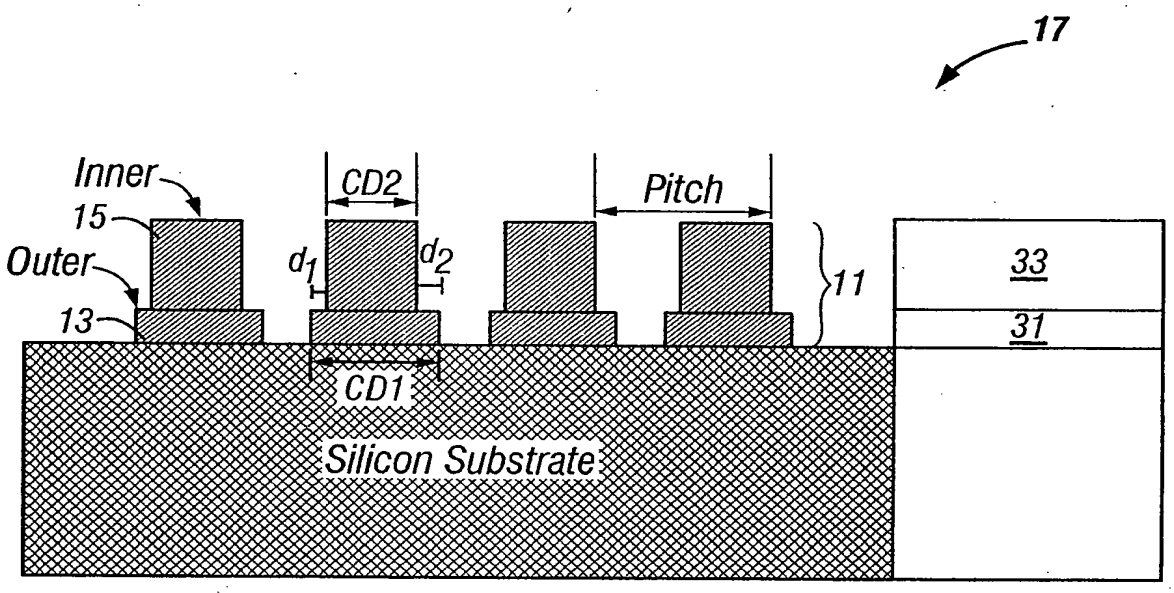
17
Inner
15
Outer
13
CD2
Pitch
d_1
d_2
11
33
31
CD1
Silicon Substrate

FIG. 2a

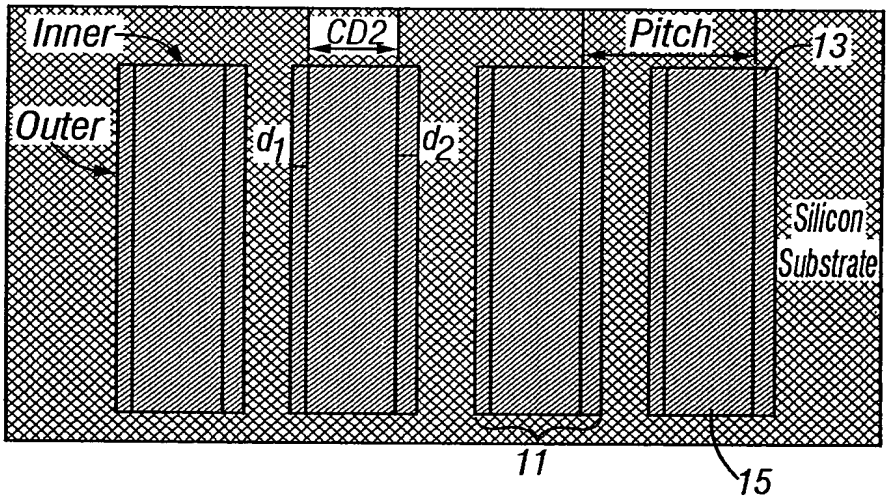
Inner
CD2
Pitch
13
Outer
d_1
d_2
Silicon
Substrate
11
15

FIG. 2b

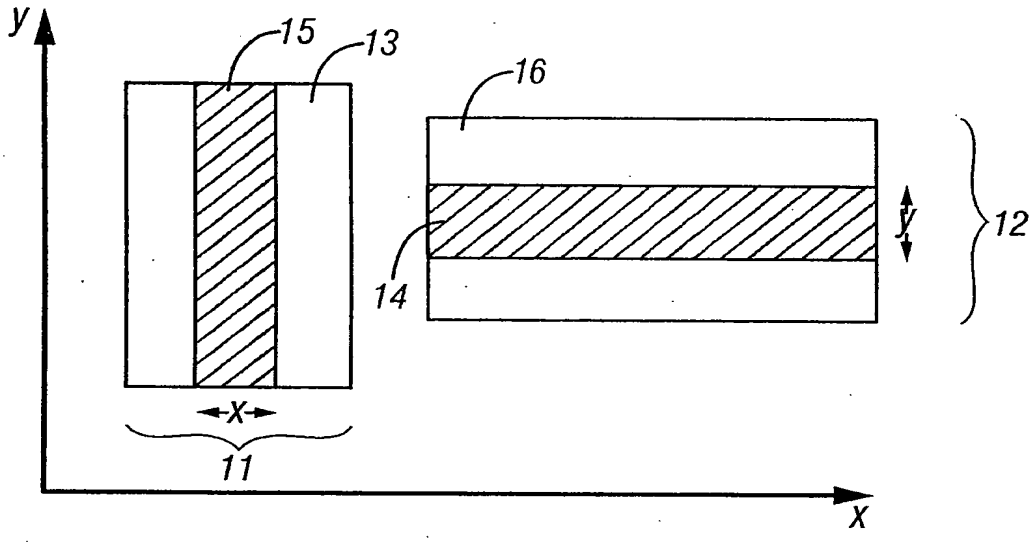
y
15
13
16
14
y
12
X
11
X

FIG. 2c

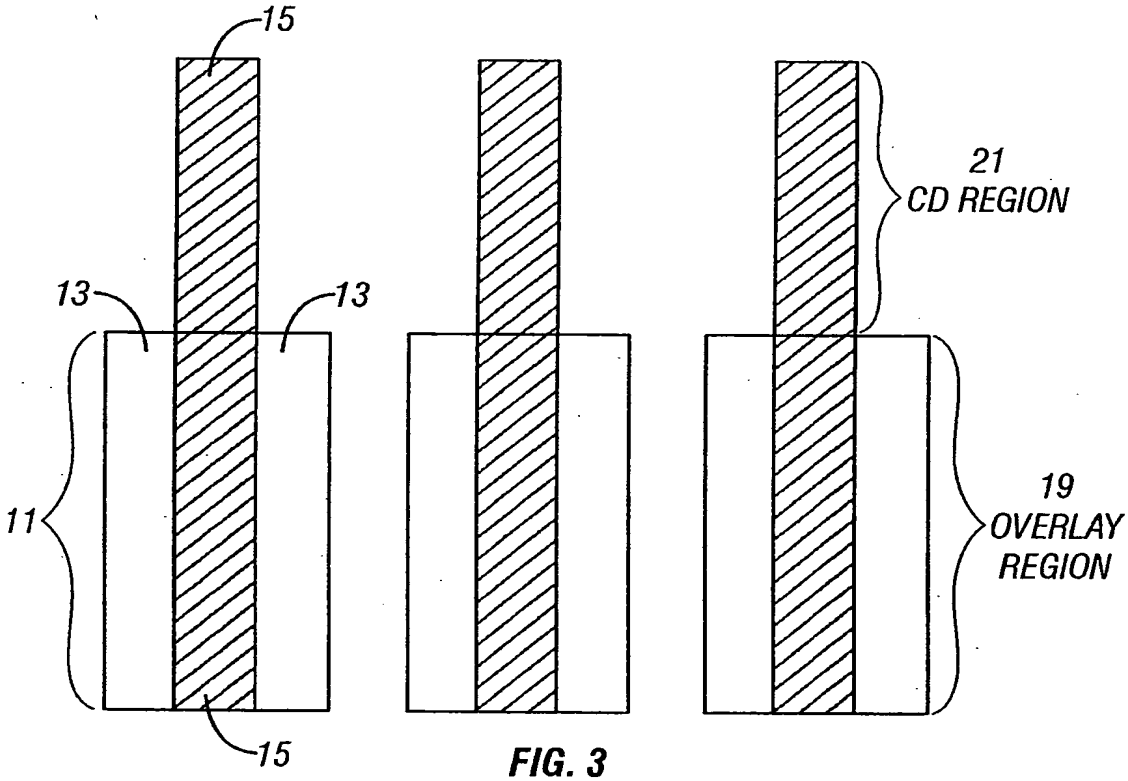
15
13
13
11
15
21
CD REGION
19
OVERLAY
REGION

FIG. 3

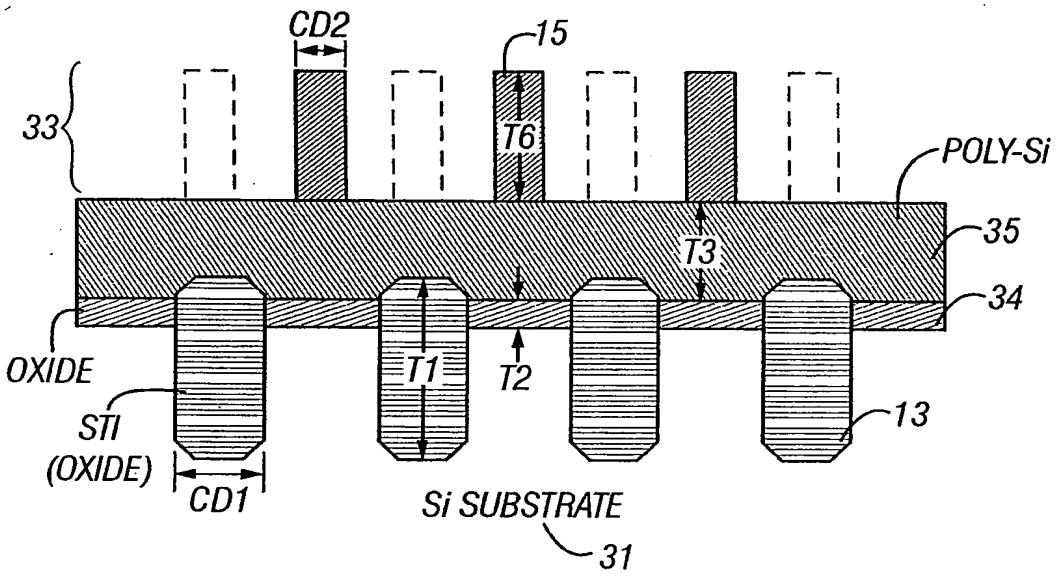
CD2
15
33
T6
POLY-Si
35
T3
34
OXIDE
T1
T2
STI
(OXIDE)
13
CD1
Si SUBSTRATE
31

FIG. 4a

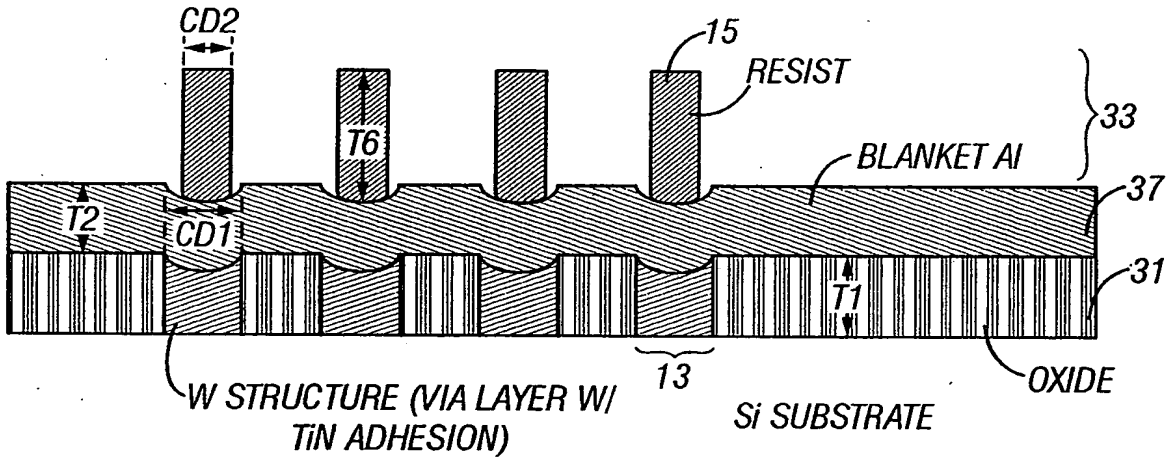
CD2
15
RESIST
33
T6
BLANKET Al
37
T2
CD1
31
T1
13
OXIDE
W STRUCTURE (VIA LAYER W/
TiN ADHESION)
Si SUBSTRATE

FIG. 4b

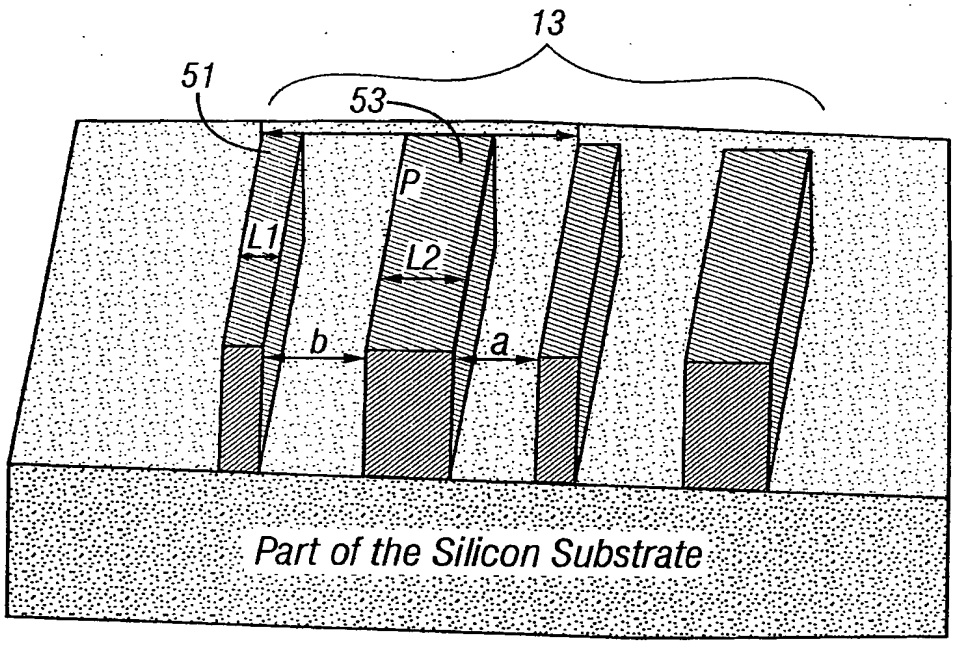
13
51
53
P
L1
L2
b
a
Part of the Silicon Substrate

FIG. 5a

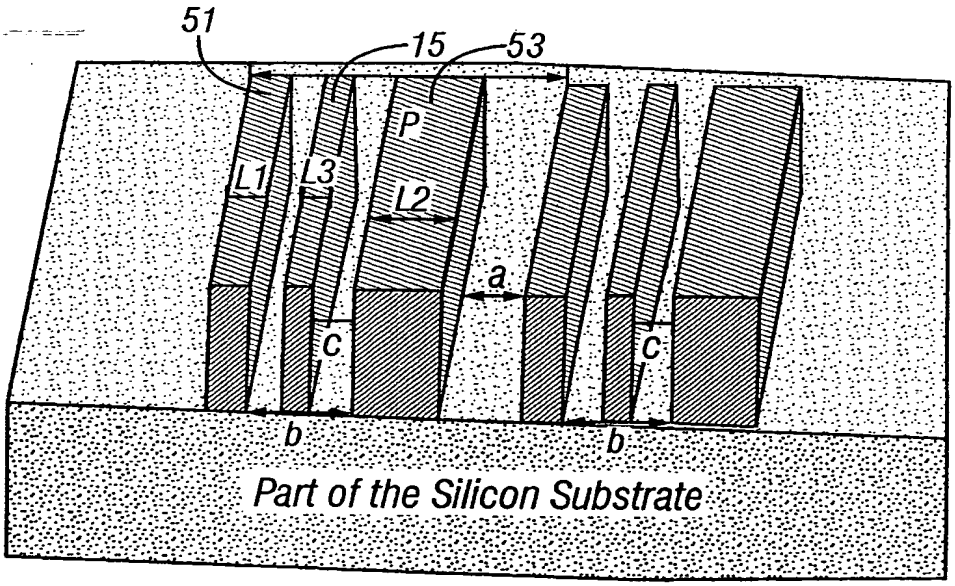
51
15
53
P
L1
L3
L2
a
c
c
b
b
Part of the Silicon Substrate

FIG. 5b

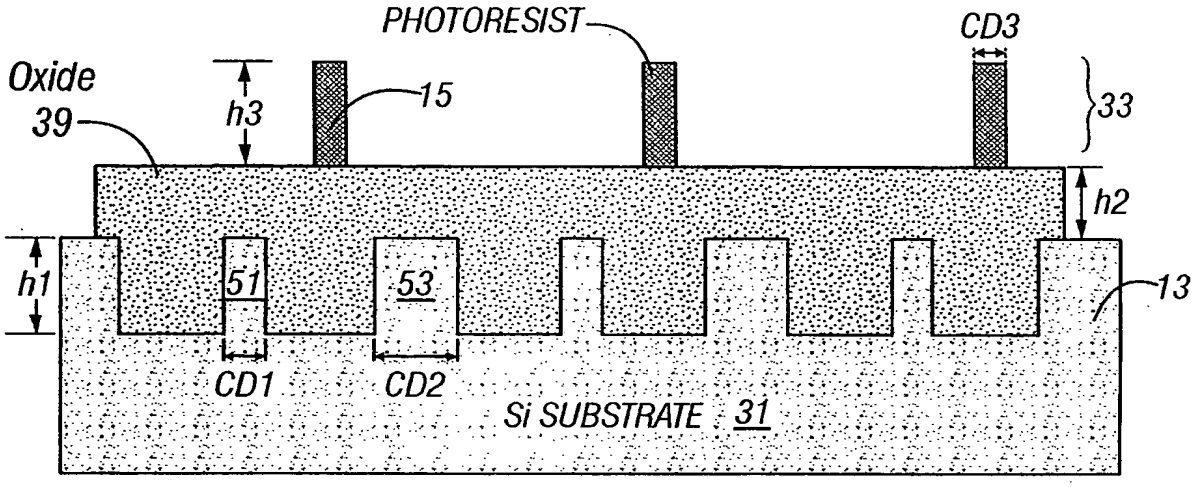

FIG. 6

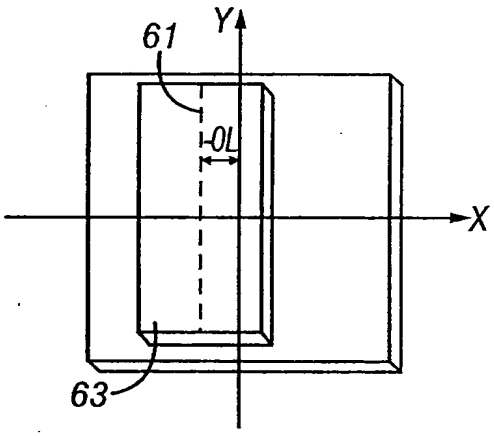

FIG. 7a

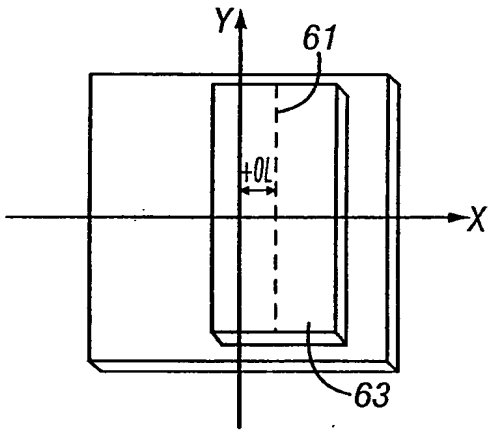

FIG. 7b

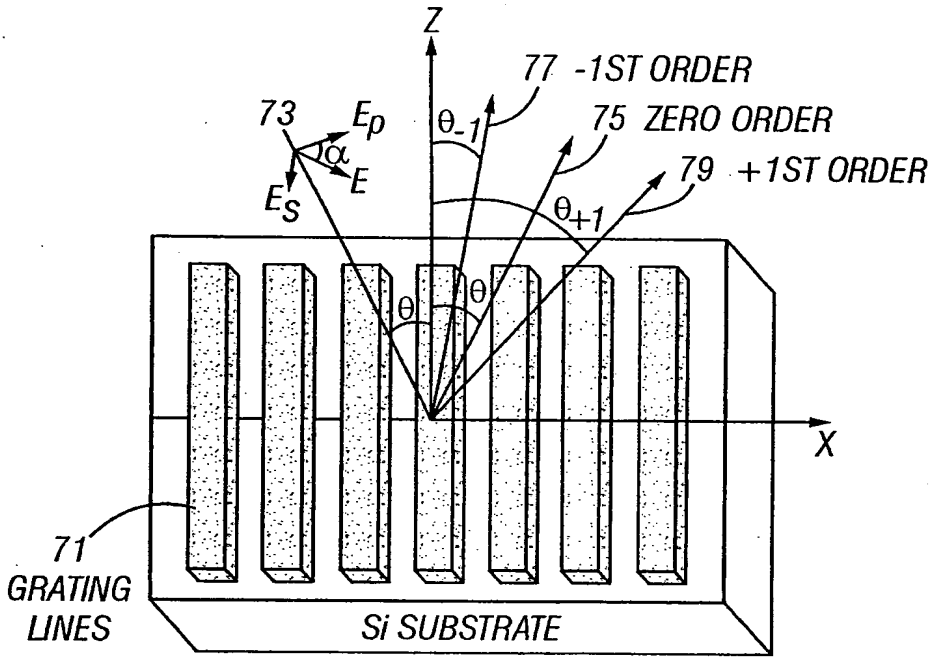
Z
77 -1ST ORDER
75 ZERO ORDER
79 +1ST ORDER
73
Ep
E
Es
θ-1
θ+1
θ
θ
X
71
GRATING
LINES
Si SUBSTRATE

FIG. 8

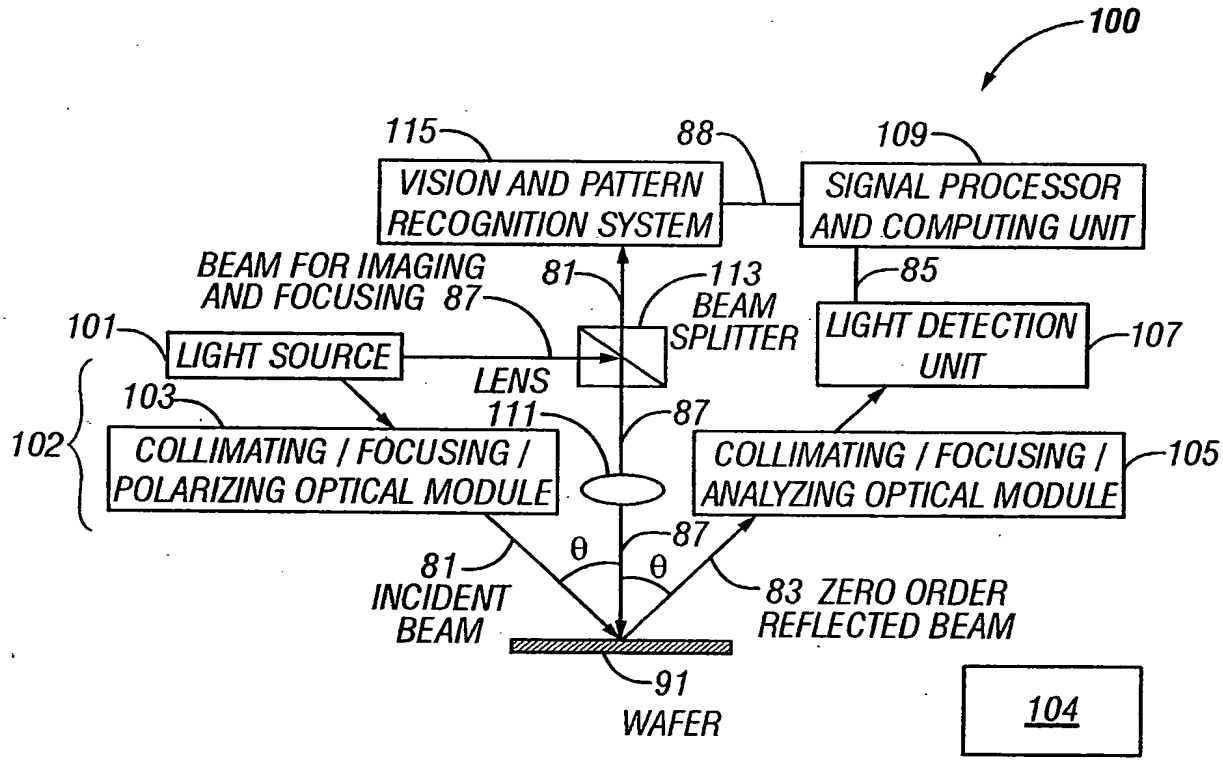
100
115
VISION AND PATTERN RECOGNITION SYSTEM
88
109
SIGNAL PROCESSOR AND COMPUTING UNIT
BEAM FOR IMAGING AND FOCUSING 87
81
113
BEAM SPLITTER
85
101
LIGHT SOURCE
LENS
LIGHT DETECTION UNIT
107
103
111
87
102
COLLIMATING / FOCUSING / POLARIZING OPTICAL MODULE
COLLIMATING / FOCUSING / ANALYZING OPTICAL MODULE
105
θ
θ
87
81
INCIDENT BEAM
83 ZERO ORDER REFLECTED BEAM
91
WAFER
104

FIG. 9a

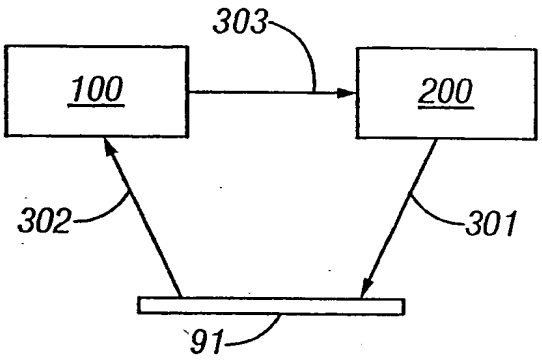

FIG. 9b

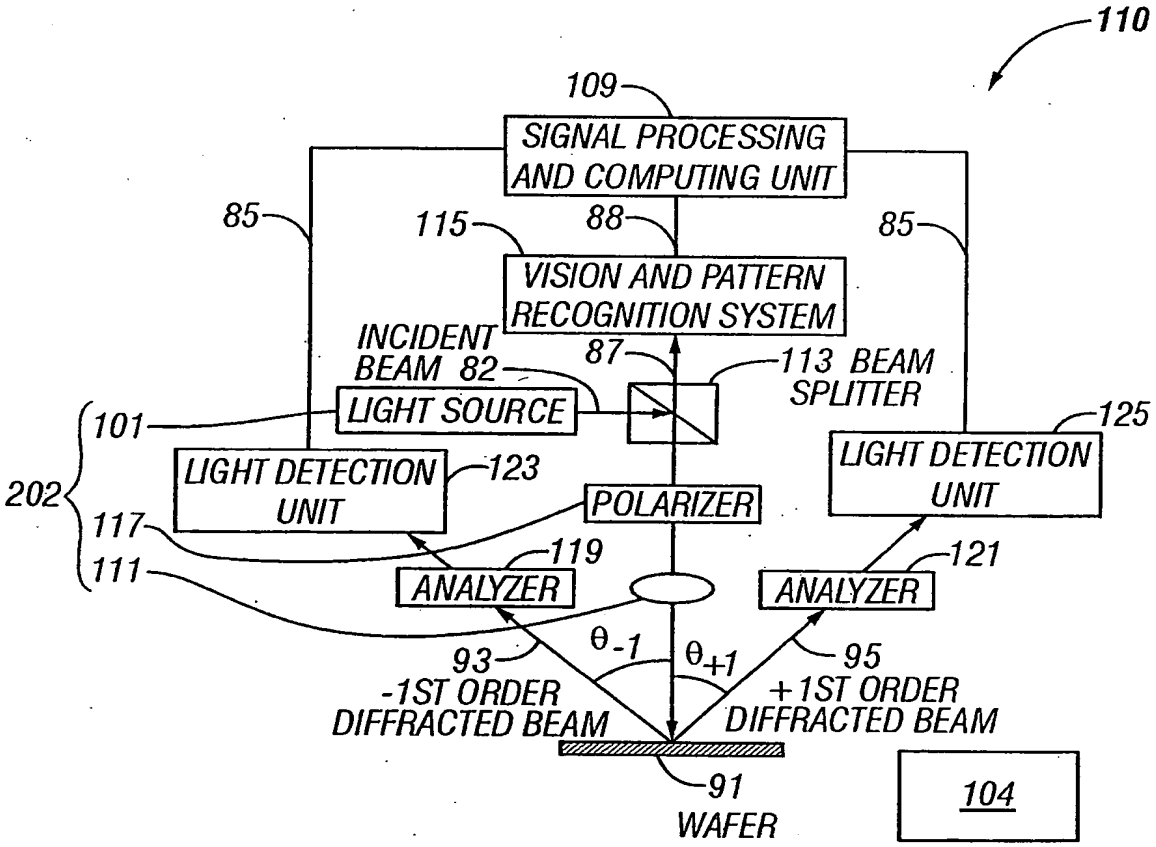

FIG. 10a

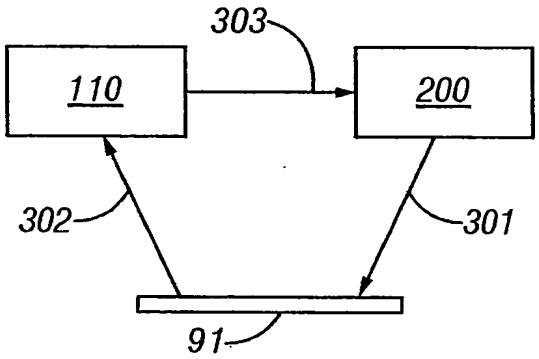

FIG. 10b

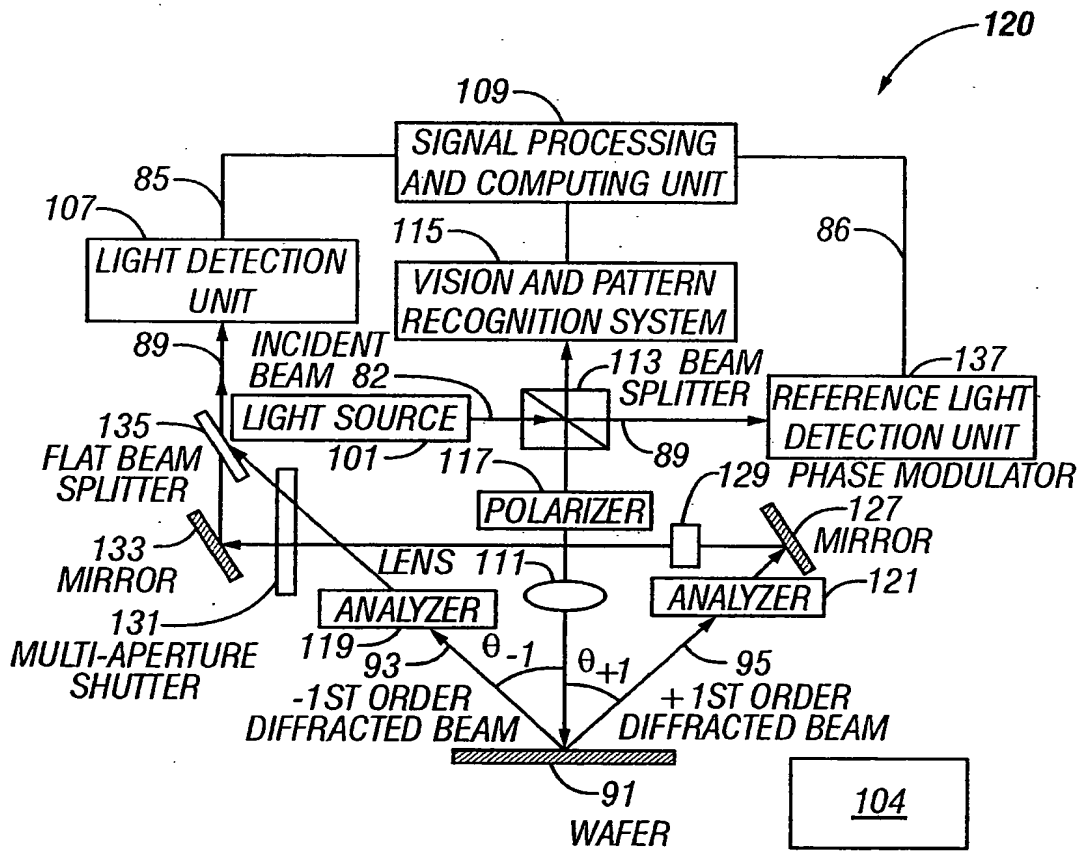

FIG. 11a

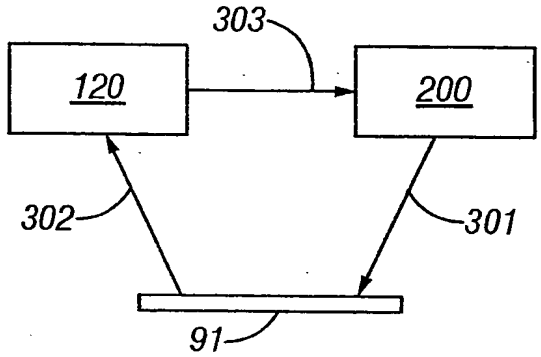

FIG. 11b

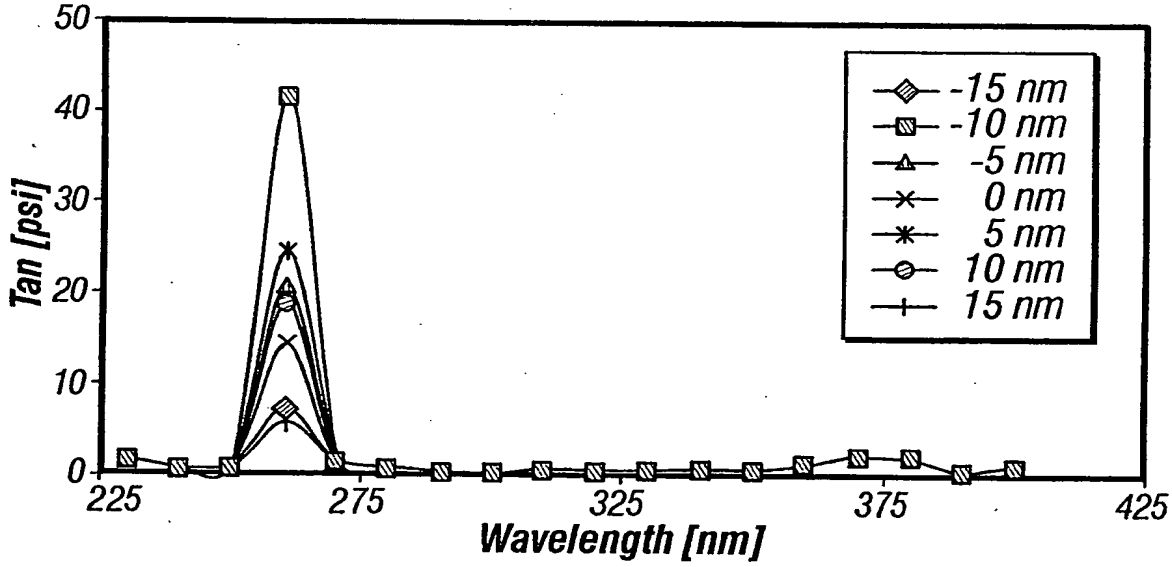

FIG. 12a

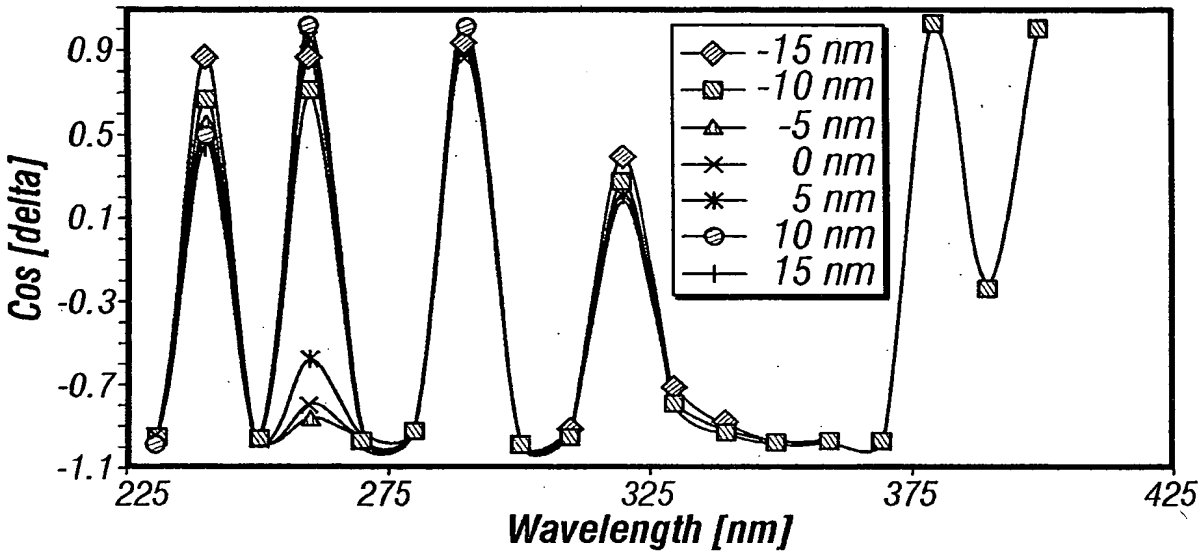

FIG. 12b

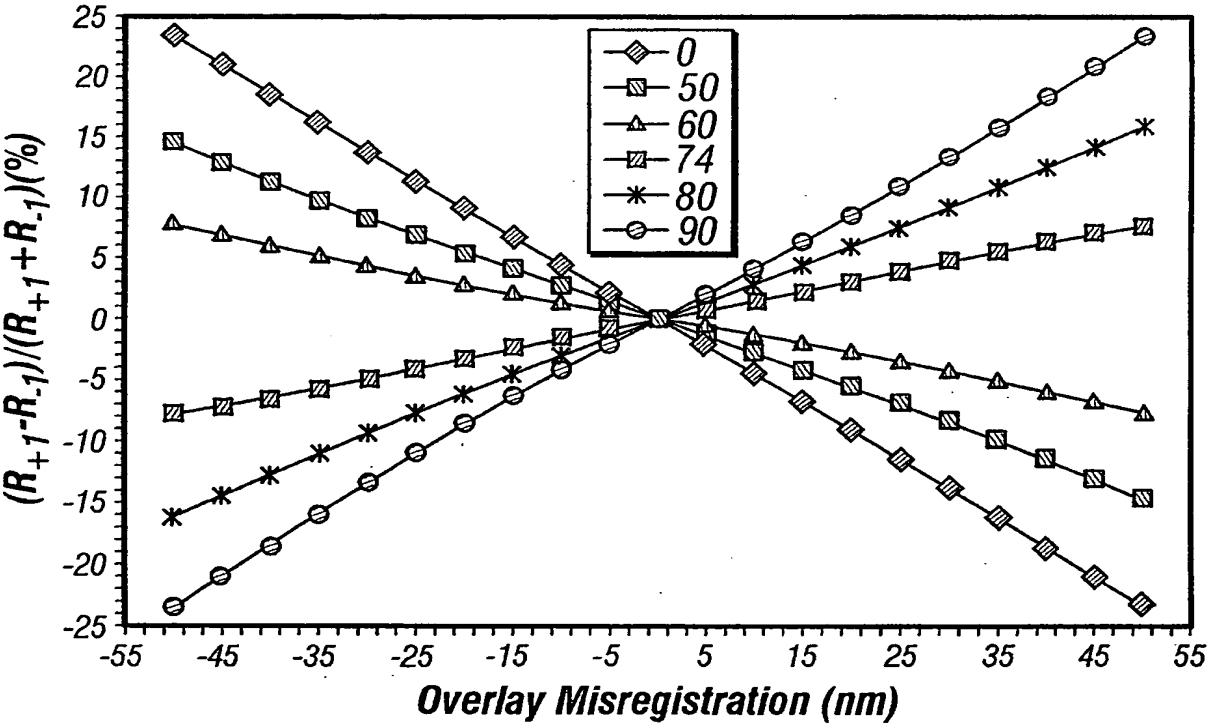

FIG. 13

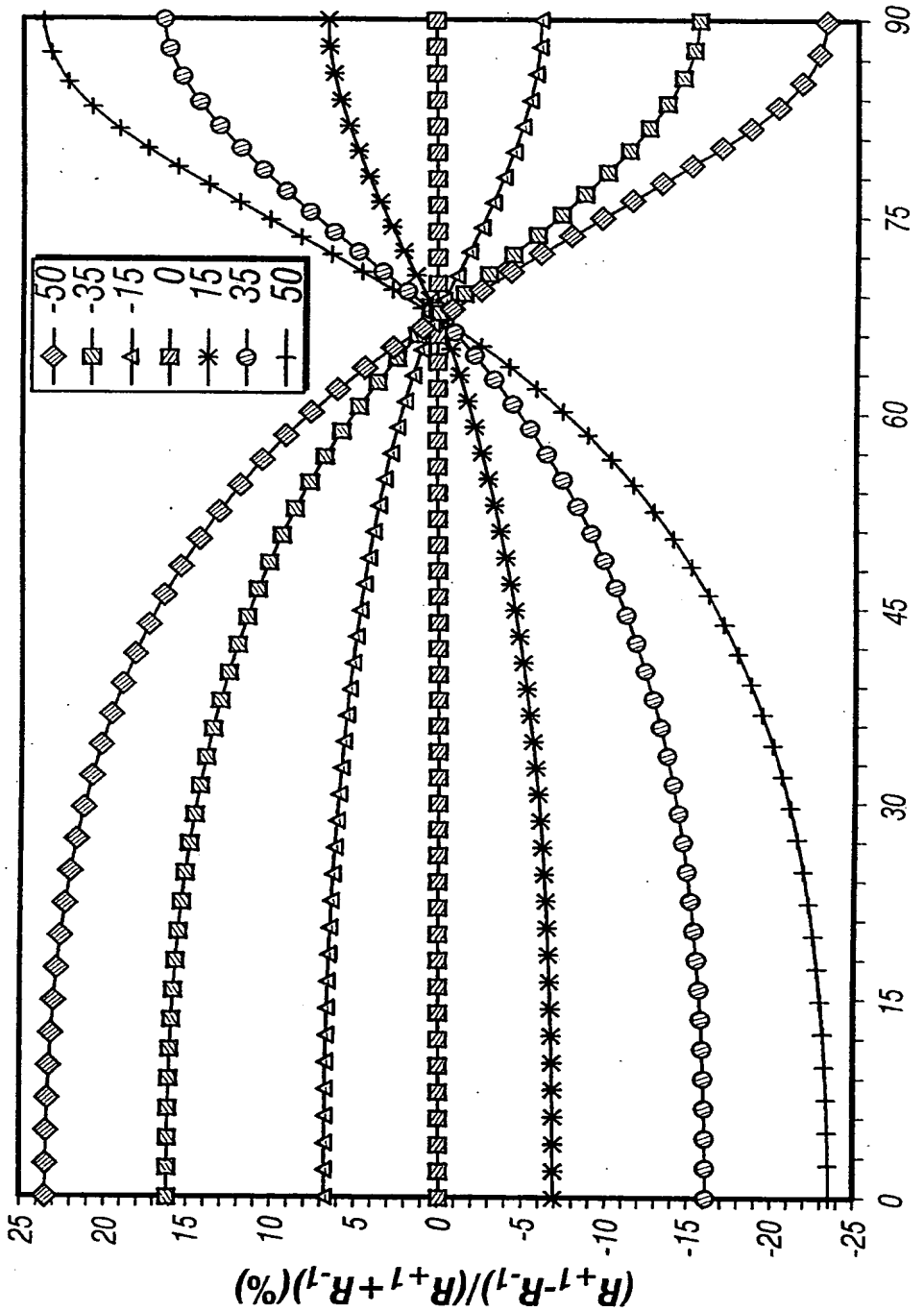
-50
-35
-15
0
15
35
50
25
20
15
10
5
0
-5
-10
-15
-20
-25
0
15
30
45
60
75
90
(R+1-R-1)/(R+1+R-1)(%)
Incident Polarization Angle

FIG. 14

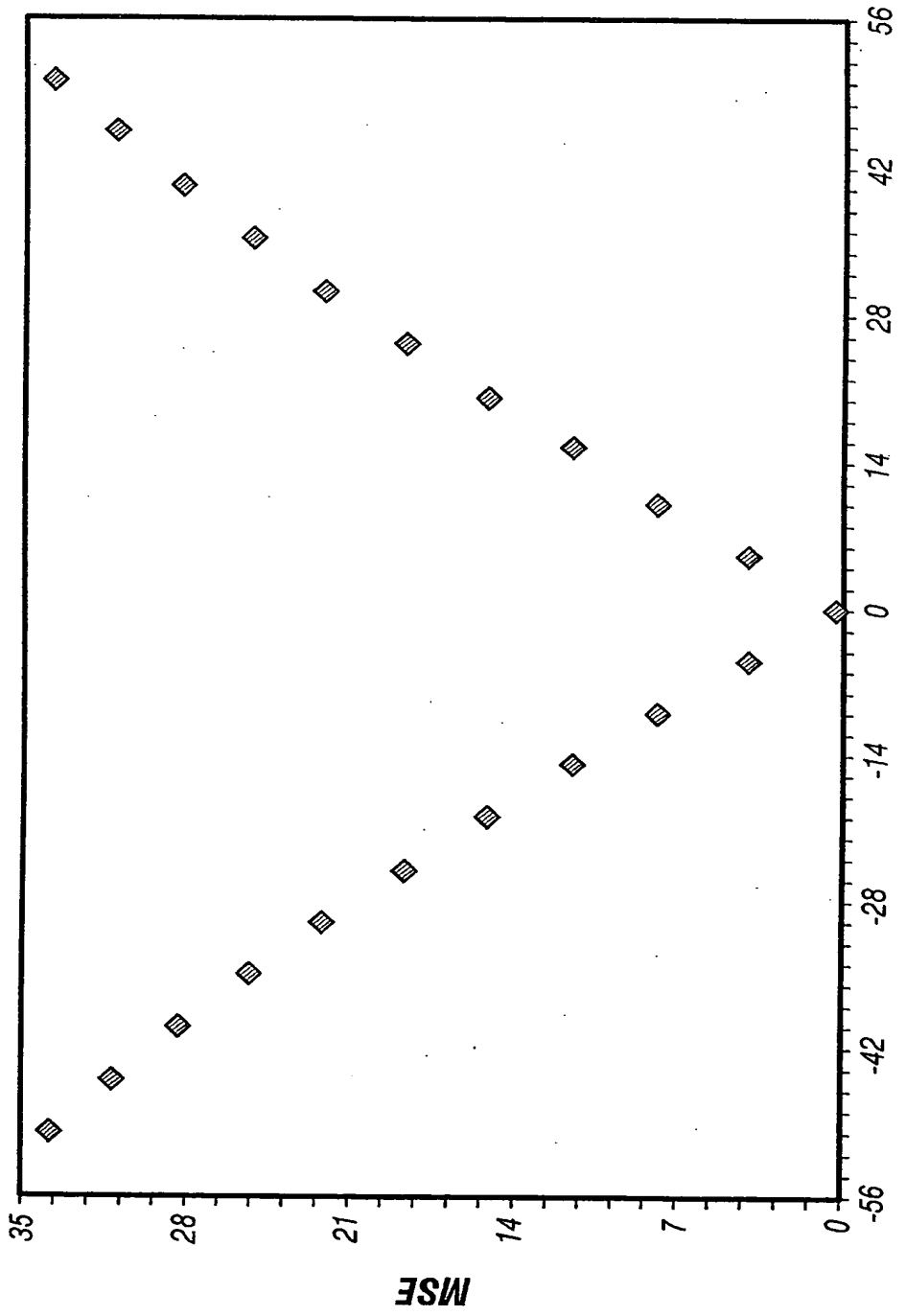

FIG. 15

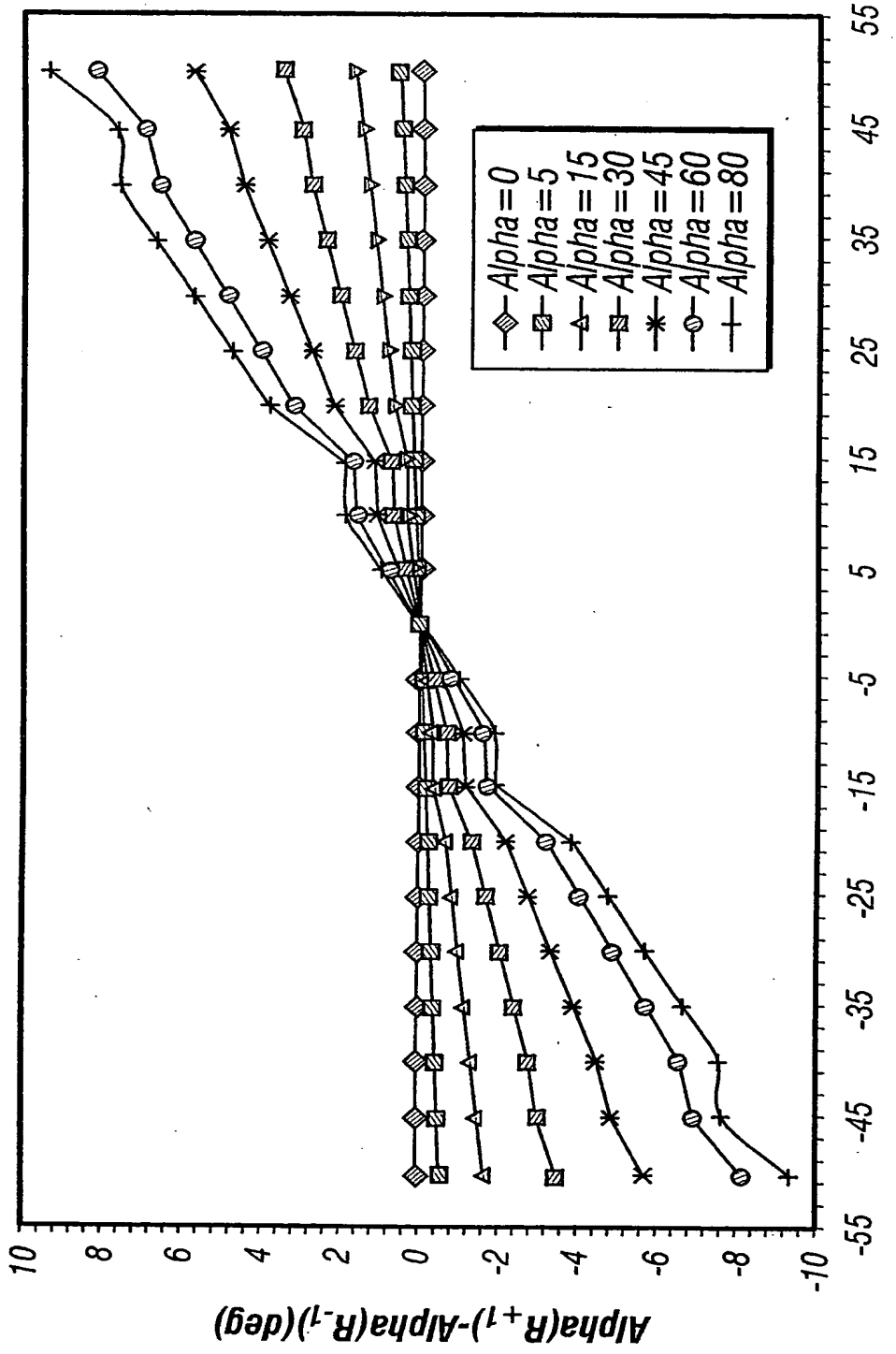
Alpha=0
Alpha=5
Alpha=15
Alpha=30
Alpha=45
Alpha=60
Alpha=80
Alpha(R+1)-Alpha(R-1)(deg)
10
8
6
4
2
0
-2
-4
-6
-8
-10
55
45
35
25
15
5
-5
-15
-25
-35
-45
-55
Overlay Misregistration (nm)

FIG. 16

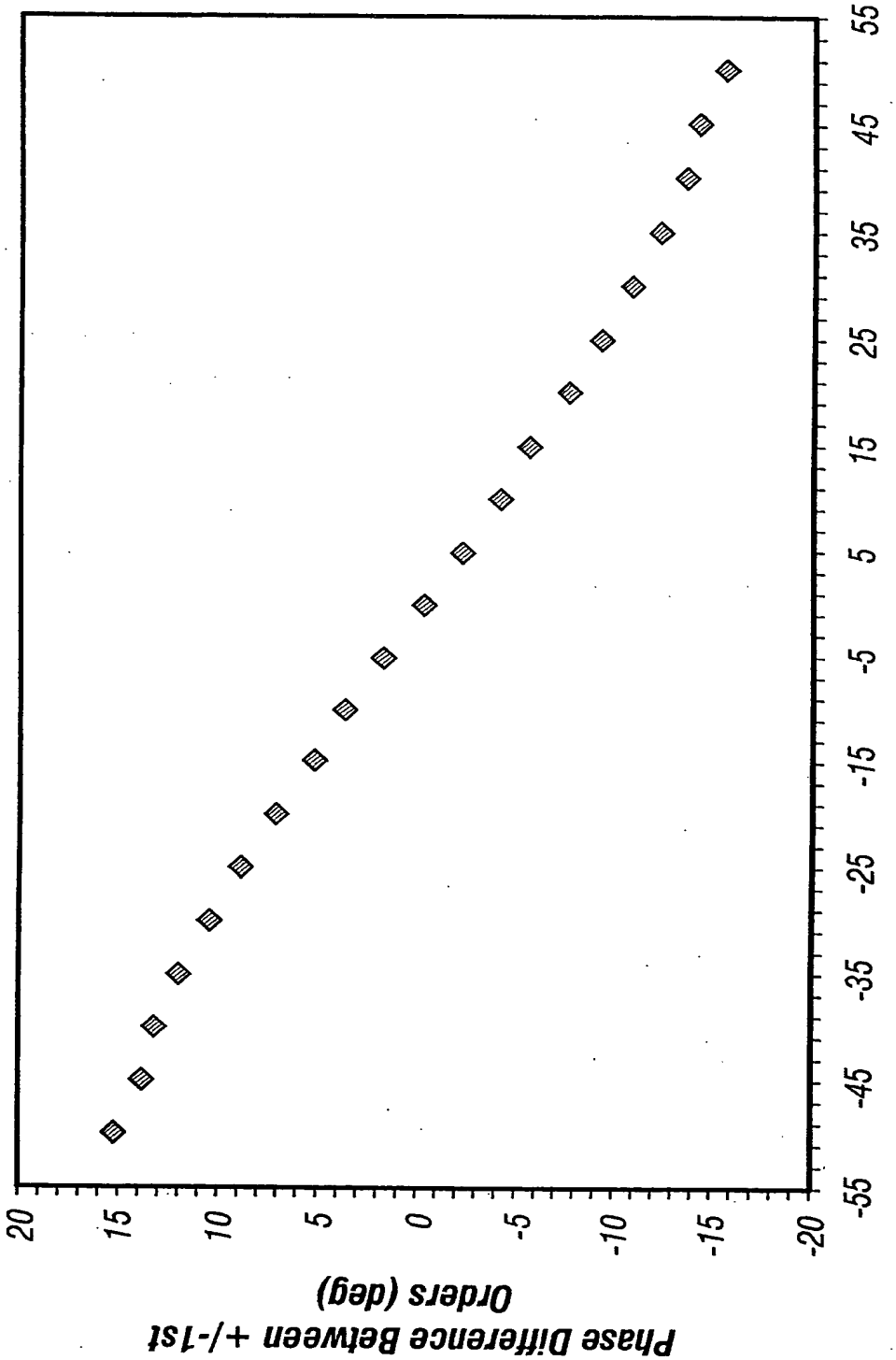
Phase Difference Between +/-1st Orders (deg)
20
15
10
5
0
-5
-10
-15
-20
Overlay Misregistration (nm)
55
45
35
25
15
5
-5
-15
-25
-35
-45
-55

FIG. 17

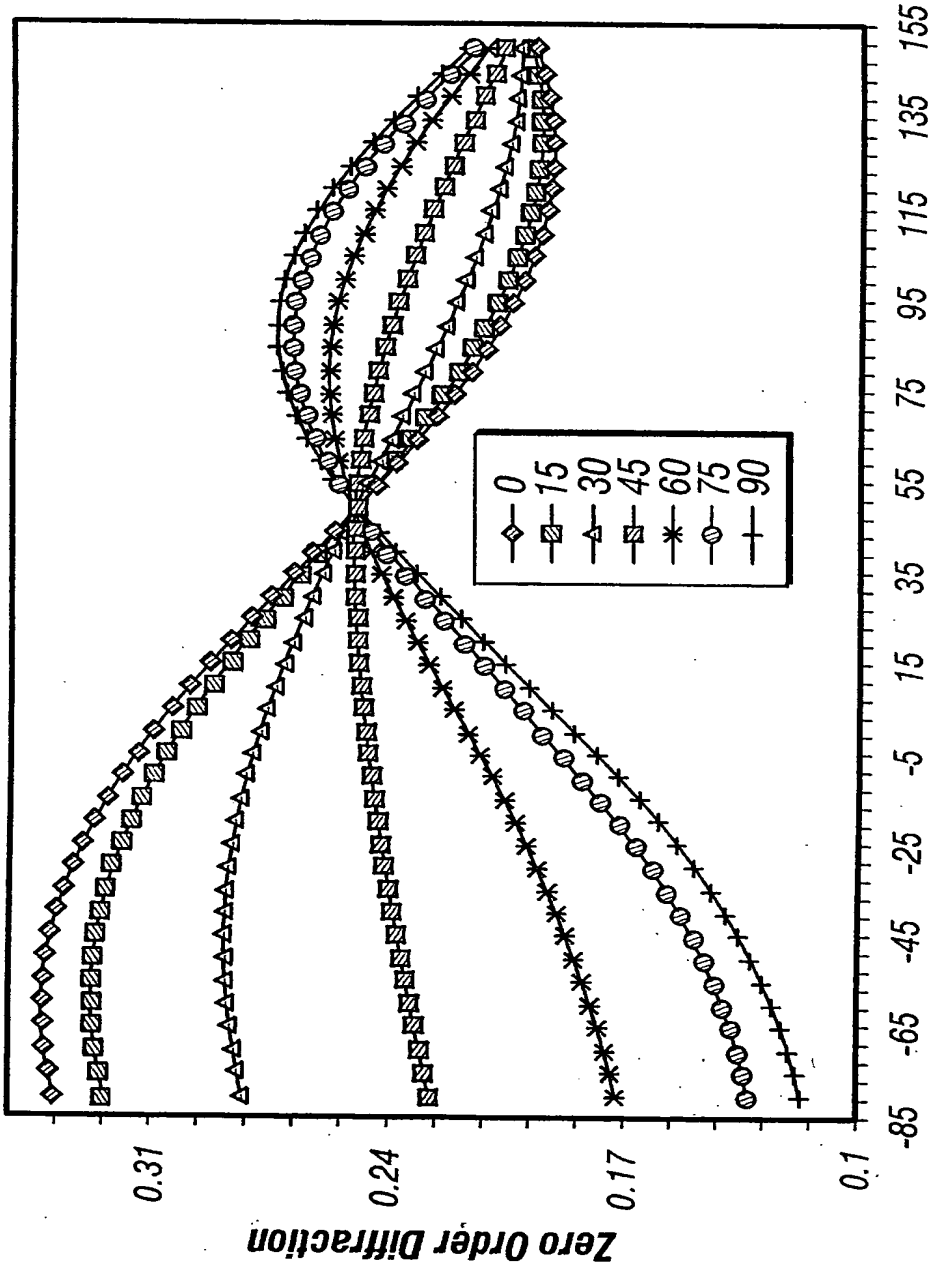
Zero Order Diffraction
0.31
0.24
0.17
0.1
-85
-65
-45
-25
-5
15
35
55
75
95
115
135
155
Overlay (nm)
0
15
30
45
60
75
90

FIG. 18

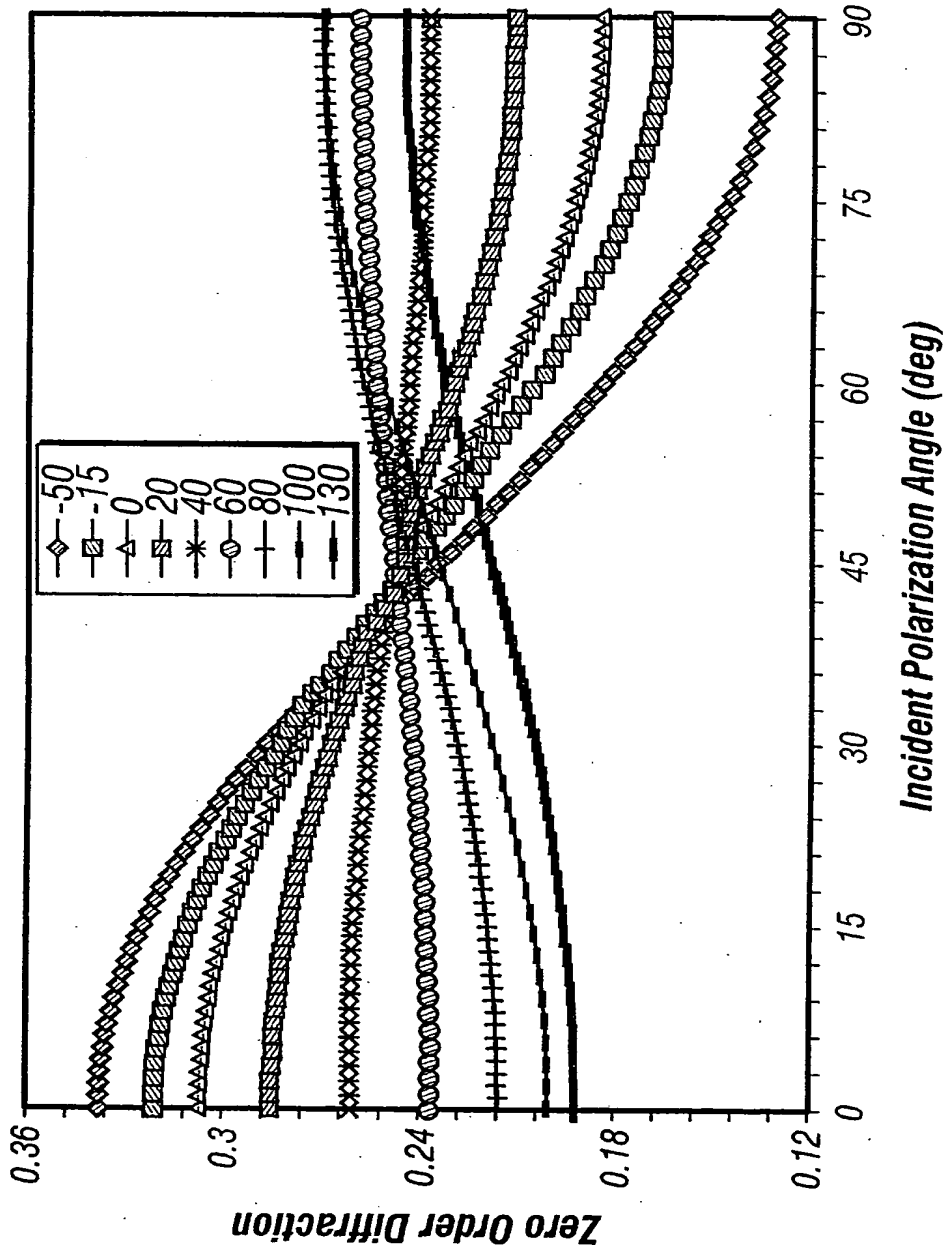
Zero Order Diffraction
0.36
0.3
0.24
0.18
0.12
0
15
30
45
60
75
90
Incident Polarization Angle (deg)
-50
-15
0
20
40
60
80
100
130

FIG. 19

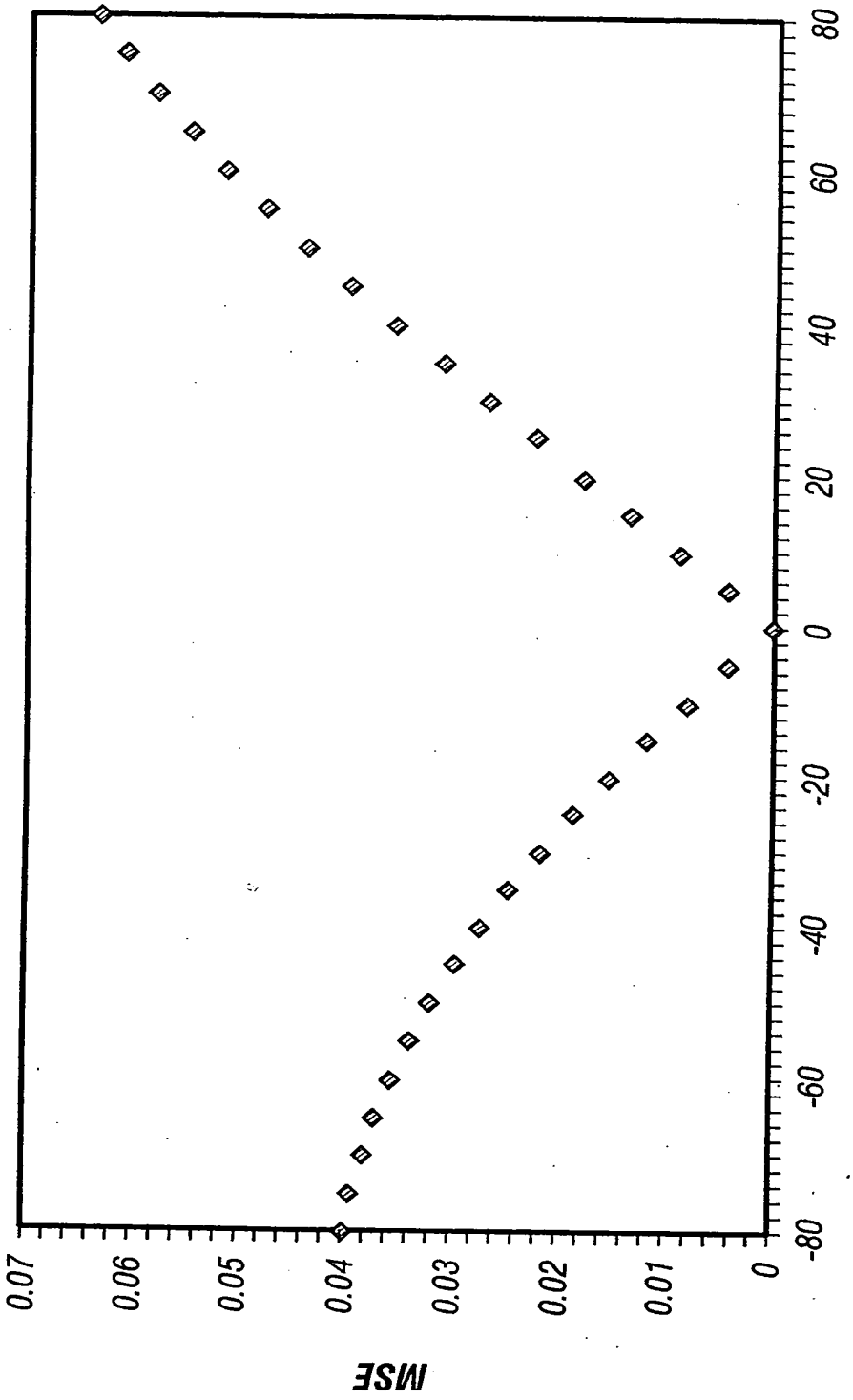
MSE
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Overlay (nm)
80
60
40
20
0
-20
-40
-60
-80

FIG. 20

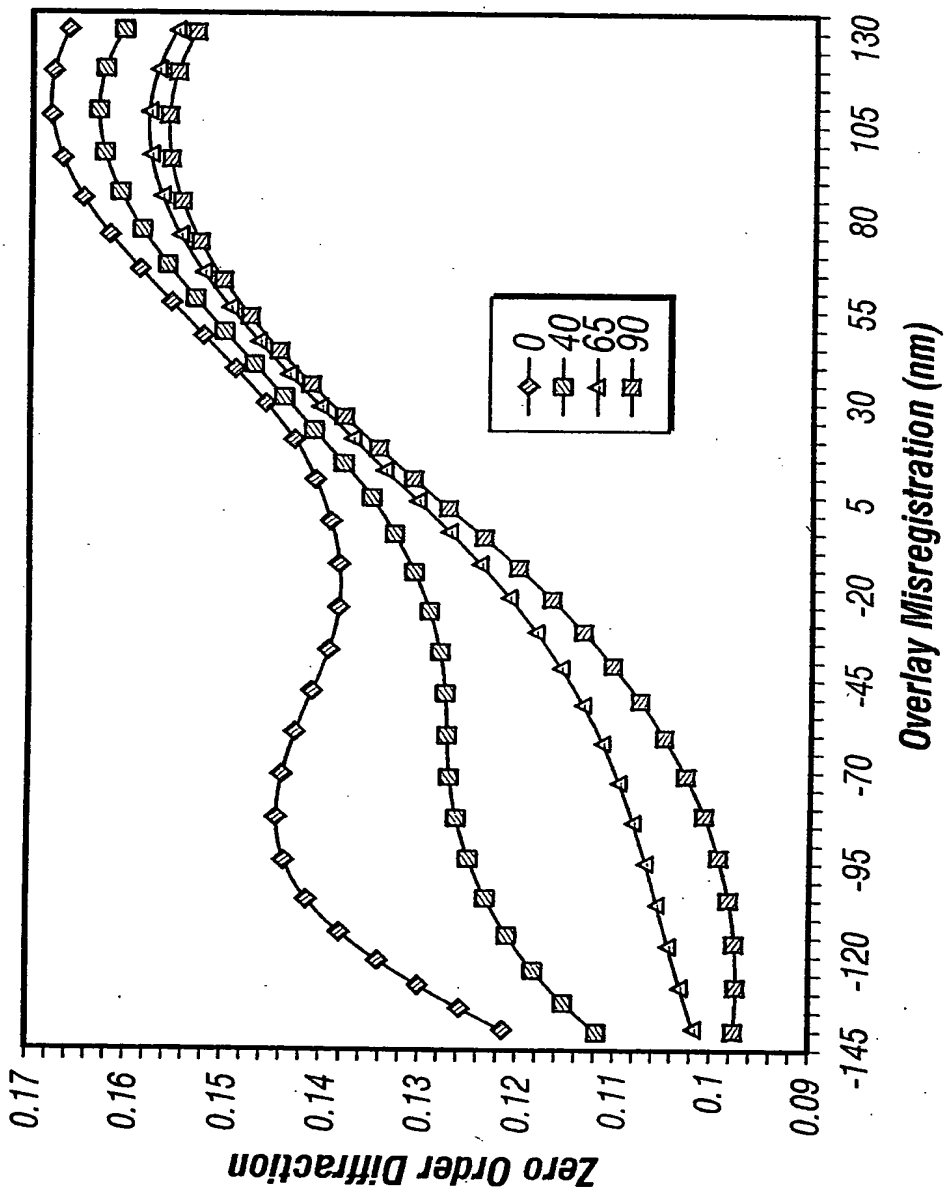
Zero Order Diffraction
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
Overlay Misregistration (nm)
-145
-120
-95
-70
-45
-20
5
30
55
80
105
130
0
40
65
90

FIG. 21

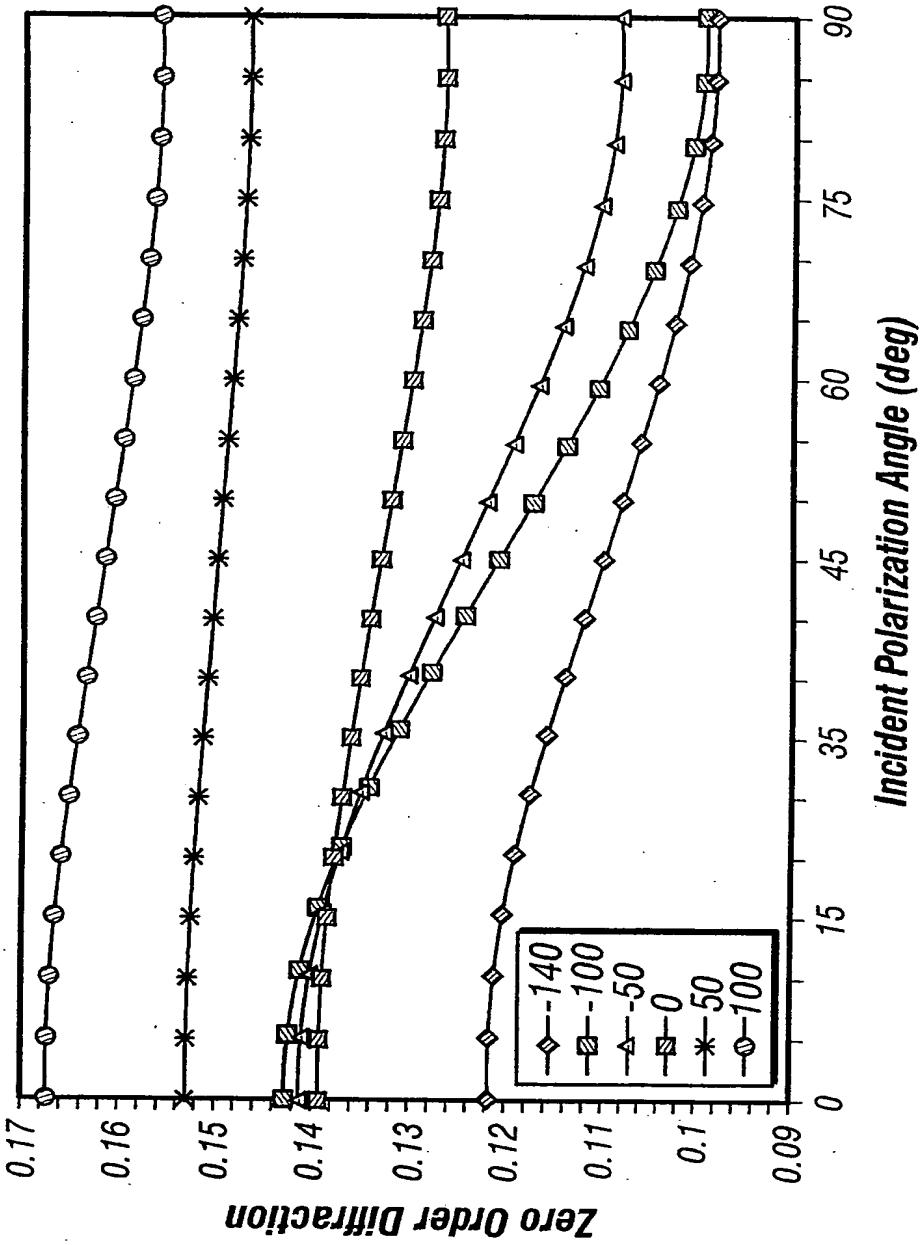
Zero Order Diffraction
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0
15
35
45
60
75
90
Incident Polarization Angle (deg)
-140
-100
-50
0
50
100

FIG. 22

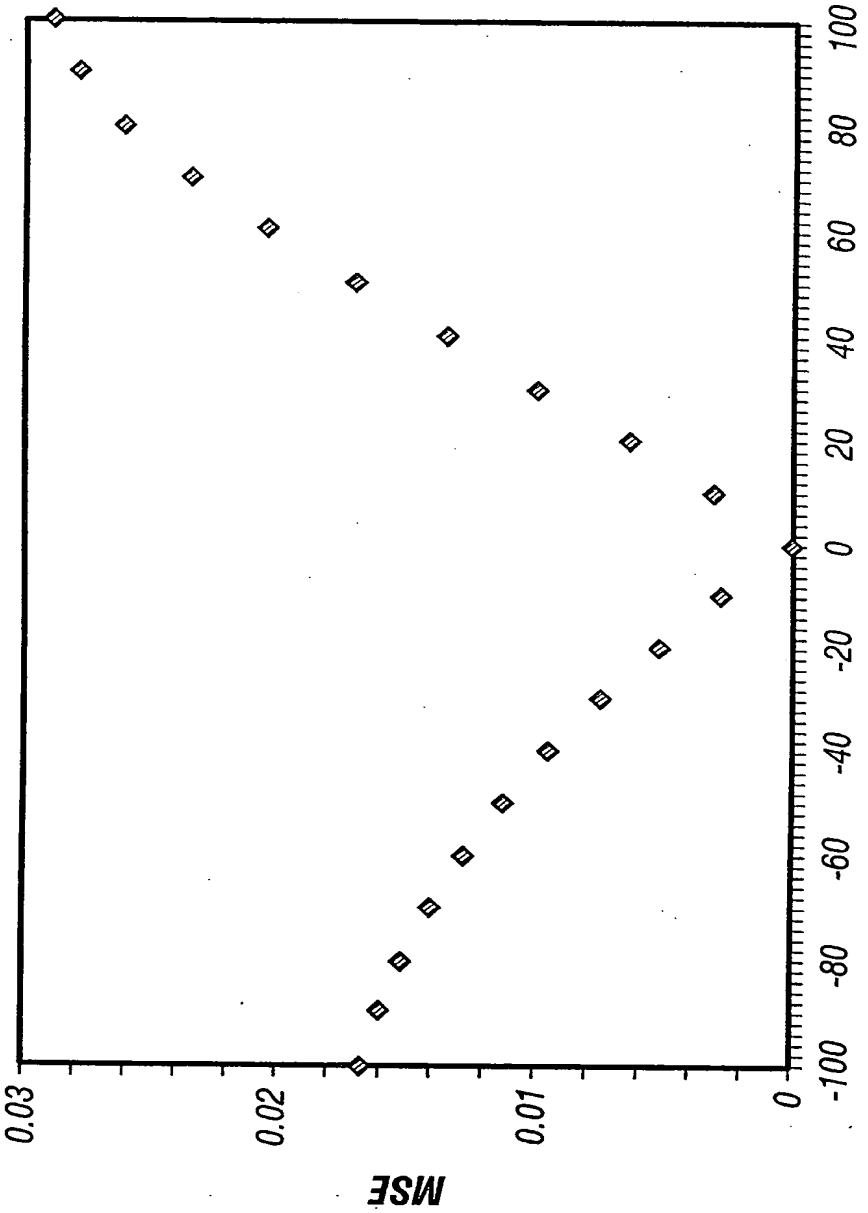

FIG. 23

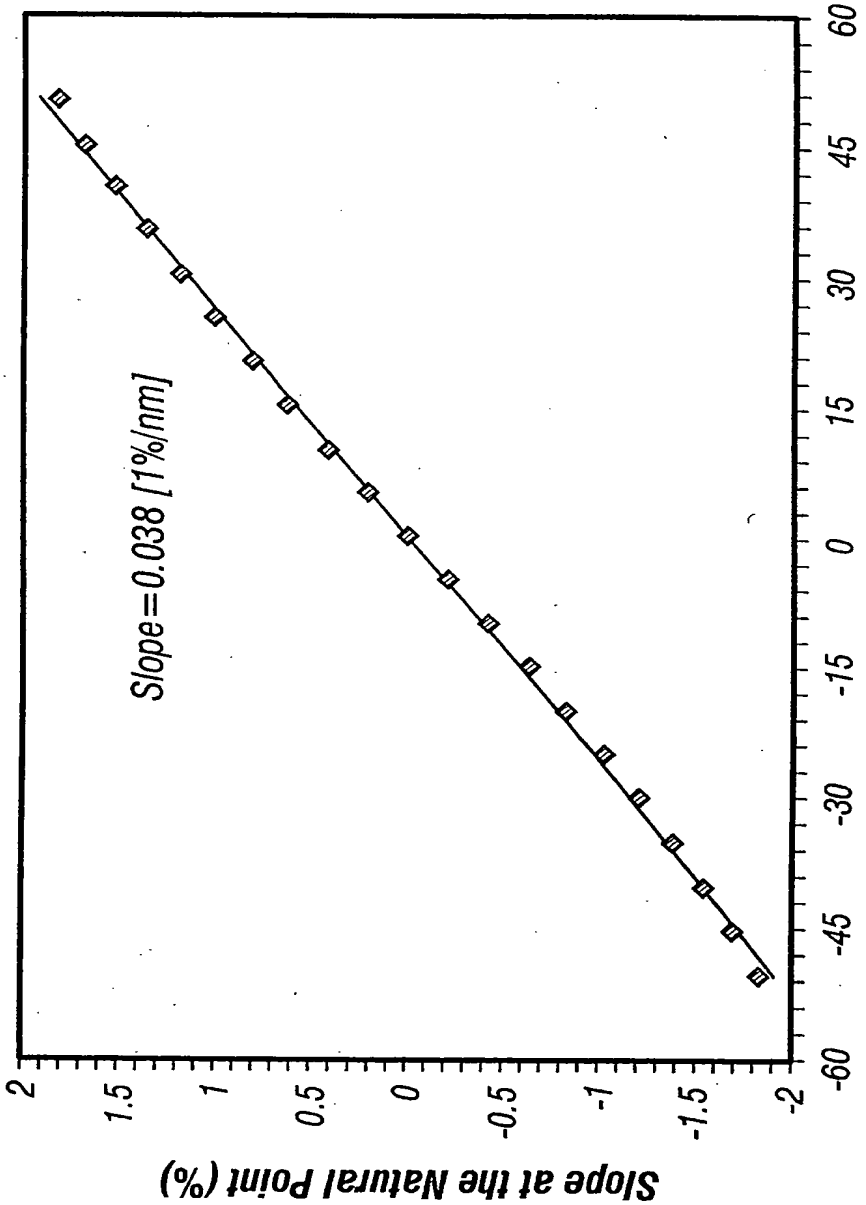
Slope=0.038 [1%/nm]
Slope at the Natural Point (%)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
60
45
30
15
0
-15
-30
-45
-60
Overlay (nm)

FIG. 24